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Reservoir Characterization of Mississippian St. Louis Carbonate Reservoir Systems in Kansas, Stratigraphic and Facies Architecture Modeling

Mississippian St. Louis (Meramecian) oolitic grainstone shoals were widely deposited across North American, and are important petroleum reservoirs in the Midcontinent. To develop an improved understanding of the depositional controls on complex geometry and distribution of St. Louis oolitic grainstone reservoirs, the external geometry and spatial continuity of individual selected oolite shoals were mapped in 3-D.

An integrated geologic and geostatistical approach was used to model the 3-D sequence stratigraphic, lithofacies, and reservoir architectural framework of the St. Louis carbonate reservoir systems in three fields in Southwestern Kansas. Sequence stratigraphic surfaces were recognized from both cores and logs, and provided the basis to construct a sequence stratigraphic framework to constrain further reservoir analysis. Lithofacies were described and classified using core from approximately 20 available wells. A nonparametric discriminant analysis tool (Kipling.xla) was used to calibrate core-scaled lithofacies to log-scaled petrofacies using suites of log curves (GR, resistivity, density and neutron porosity, and PE). Using the Kipling approach, log attributes from more than 200 wells were used to predict lithofacies and petrofacies in wells without cores. The predicted results provided input for stochastic object-based modeling of the 3-D geometry and connectivity of individual oolite lobes. An improved representation of the flow units was defined within a sequence stratigraphic framework.

Improved quantitative lithofacies and petrofacies models for St. Louis carbonate reservoir systems can improve our understanding of key factors that control the facies distribution, and the production of hydrocarbons within carbonate shoals.